

# PROSPECTIVE STUDY: COMPARISON OF PRONE AND SUPINE POSITION IN PERCUTANEOUS NEPHROLITHOTOMY (PCNL) AT ADAM MALIK HOSPITAL MEDAN

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## ABSTRACT

**Objective:** This prospective study aims to compare the outcomes of PCNL with prone position compared to the supine position. **Material & Methods:** A total of 57 patients treated with PCNL from January 2017-December 2017 were included in the study. Inclusion criteria include patients with kidney stones greater than 20 mm in size measured with KUB imaging (Kidney-Ureter-Bladder) or abdominal NCCT (Non Contrast Computed Tomography) who were willing to be treated with PCNL. The exclusion criteria were patients younger than 17 years of age, patients who refused to surgery, patients with history of PCNL on the same side, patients with blood clotting disorders, pregnancy, and kidney stone in patients with congenital kidney disorders. Patients were randomized to undergo PCNL with prone or supine position. A total of 29 patients were treated with PCNL in prone position and 28 patients were treated in supine position. Data on patient characteristics, puncture location, number of puncture, use of post PCNL nephrostomy, duration of surgery, presence or absence of residual stones measuring  $\geq 5$  mm in size, total complications, postoperative fever, sepsis, bleeding requiring transfusion, retroperitoneal hematoma, pleural effusion, intestinal injury, and the difference between hemoglobin count before and after surgery was compared between the two groups. **Results:** There were no significant differences observed in terms of number, sex, age, BMI, stone size, hydronephrosis, and comorbidities in patients of both groups. Stone free rate in PCNL with prone position and supine position is 82.8% and 92.9% respectively. Significant comparisons were observed on differences in the mean duration of surgery in which PCNL duration of surgery with the prone position was 150 minutes whereas the supine position took 130 minutes ( $p=0.003$ ). There were no significant differences between successful puncture, total complications, postoperative fever, sepsis, and bleeding requiring transfusion. There were no patients who had pleural effusion, intestinal injury, or death in this study. **Conclusion:** PCNL in supine position has the same effectiveness and safety as PCNL in prone position. The Stone free rate is higher in PCNL performed in supine position. The duration of PCNL surgery in supine position is significantly shorter than the PCNL prone position.

**Keywords:** PCNL, prone, supine, surgery.

## ABSTRAK

**Tujuan:** Penelitian prospektif ini bertujuan untuk membandingkan hasil PCNL dengan posisi prone dengan posisi supine. **Bahan & Cara:** Sebanyak 57 pasien yang diobati dengan PCNL dalam periode 1 Januari 2017 hingga 31 Desember 2017 dilibatkan dalam penelitian ini. Kriteria inklusi mencakup pasien dengan batu ginjal yang berukuran lebih dari 20 mm yang diukur dengan KUB (Ginjal-Ureter-Kandung Kemih) atau NCCT perut (Non Contrast Computed Tomography) yang bersedia diobati dengan PCNL. Kriteria eksklusi adalah pasien yang lebih muda dari 17 tahun, pasien yang menolak untuk operasi, pasien dengan riwayat PCNL di sisi yang sama, pasien dengan gangguan pembekuan darah, kehamilan, dan batu ginjal pada pasien dengan kelainan ginjal bawaan. Pasien diacak untuk menjalani PCNL dengan posisi prone dan supine. Sebanyak 29 pasien diobati dengan PCNL dalam posisi prone dan 28 pasien pasien dirawat dalam posisi supine. Data karakteristik pasien, lokasi tusukan, jumlah tusukan, penggunaan nefrostomi pasca PCNL, lama operasi, ada atau tidaknya batu sisa berukuran  $\geq 5$  mm, total komplikasi, demam pasca operasi, sepsis, perdarahan yang membutuhkan transfusi, hematoma retroperitoneal, efusi pleura, cedera usus, dan perbedaan antara jumlah hemoglobin sebelum dan sesudah operasi dibandingkan antara kedua kelompok. **Hasil:** Tidak ada perbedaan signifikan yang diamati dalam jumlah, jenis kelamin, usia, IMT, ukuran batu, hidronefrosis, dan komorbiditas pada pasien dari kedua kelompok. Tingkat bebas batu di PCNL dengan posisi prone dan supine adalah masing-masing 82.8% dan 92.9%. Perbandingan signifikan diamati pada perbedaan dalam durasi rata-rata operasi di mana durasi PCNL operasi dengan posisi prone adalah 150 menit sedangkan posisi supine mengambil 130 menit ( $p=0.003$ ). Tidak ada perbedaan yang signifikan antara tusukan yang berhasil, komplikasi total, demam pasca operasi, sepsis, dan perdarahan yang membutuhkan transfusi. Tidak terdapat pasien yang memiliki efusi pleura, cedera usus, atau kematian dalam penelitian ini. **Simpulan:** PCNL dalam posisi supine memiliki efektivitas dan keamanan yang sama dengan PCNL dalam posisi prone. Tingkat bebas batu lebih tinggi pada

*PCNL yang dilakukan pada posisi supine. Durasi operasi PCNL dalam posisi supine secara signifikan lebih pendek dari posisi PCNL prone.*

**Kata Kunci:** PCNL, prone, supine, operasi.

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## INTRODUCTION

Humans are known to have had urinary tract stones for centuries. The oldest case of kidney stones was found by Shattock et al in Egyptian mummies originating from 4400 BC.<sup>1</sup> The prevalence of urinary tract stones is 5-15% of the entire world population with a recurrence rate of almost 50%.<sup>2-4</sup> Urinary tract stones still occupy the largest portion of all cases in the field of urology, but the exact incidence and prevalence of this disease in Indonesia is not yet known.<sup>5</sup>

Based on the guidelines for urinary tract stones established by EAU, PCNL is the standard management for the treatment of kidney stones >20 mm in size.<sup>6</sup> Studies show that PCNL has lower morbidity and provides patients with a higher level of comfort in postoperative patients compared to open surgery.<sup>7-8</sup>

The history of PCNL began after Goodwin published his paper describing how to make percutaneous renal access in patients in prone positions. At that time, Goodwin performed a nephrostomy for temporary drainage in kidneys with hydronephrosis followed by Fernstrom and Johansson's study, treating stones extraction through percutaneous nephrostomy access in 1976.<sup>9-10</sup> At that time, it was believed that prone position was the only position possible and safe enough to allow percutaneous renal access, giving it enough space for puncture site, and was the shortest access to the puncture. Concerns arise about the possibility of organ viscera injury and vascular injury if the procedure is performed with a position other than prone.<sup>11-12</sup> However, the prone position has its disadvantages, such as the need to change of lithotomy position to the prone position, moreover, PCNL in prone positioning becomes relative contraindication in patients with obesity and impaired cardiorespiratory functions.<sup>13</sup> In 1987, Gabriel Valdivia published the first PCNL technique using supine position.<sup>14</sup> Eleven years later, Valdivia

et al. published their writing after working on 557 PCNL cases in supine position.<sup>15</sup> Since then, urologists' interest in working and publishing their writings on PCNL with supine position has greatly increased.<sup>16</sup>

PCNL with prone and supine positions have their advantages and disadvantages. Prone positioning provides a wider area to work with, thus giving it more flexibility in terms of choosing the sites of the puncture, facilitating easier puncture and dilation, giving more possibility to do multiple punctures, and allows the operator more freedom in performing a nephroscopic maneuver during PCNL procedure. The disadvantage of prone position is the need to reposition patients from lithotomy positions to prone positions, thus increasing the risk of injury in the neck, nose, leg, and nerves in patients, requires more energy to reposition patients, requires doctors and surgical nurses to wash their hands, disinfect, and drapping twice.<sup>17-19</sup>

PCNL with prone position does not allow ureteroscopy (URS) and PCNL to be performed simultaneously.<sup>19</sup> Another disadvantage of the prone position is the restriction of breath movements, thus requires a meticulous control and evaluation of the airway from an anesthesiologist. This makes prone position not ideal for patients with comorbid of pulmonary diseases to be treated with PCNL in prone position for too long. Difficulties may be found at the beginning of the procedure if regional (spinal) anesthesia is used. Subsequently, in the course of the operation if conversion to general anesthesia is needed. This difficulty will not be found in patients with supine position.<sup>18-20</sup> The prone position is not recommended in patients with heart problems.<sup>17,20</sup> In patients with obesity, since prone position may affect the venous blood flow to the heart and interferes with breathing, it is not recommended to perform prone surgery in obese patients.<sup>13,20</sup>

The advantage of PCNL in supine position is that it is more comfortable for the patient, especially if regional anesthesia is performed. Supine position

also provides comfort for the operator because it enables the operator to perform lithotripsy of stones while sitting.<sup>13,18,21</sup> With supine position, no repositioning of patients is needed, also it does not require re-disinfection and drapping, and the doctors and surgical nurses do not need to wash their hands twice.<sup>13</sup> The supine position allows URS and PCNL to be performed simultaneously, either on the same side or on the contralateral side where ureteric stones are present.<sup>13,21</sup> Access to the kidney in the supine position is in a horizontal direction or slightly swoop up so that the flow of irrigation water flows out of the sheath. This will increase the stone-free rate in supine position, minimizes the possibility of stone fragments descending into the ureter, and also allowing the renal pelvis to have a relatively lower pressure than PCNL with prone positioning. Moreover, water absorptions in the renal pelvis with the supine position are estimated to be lower than prone position.<sup>13,17,18,21</sup>

In terms of anesthesia used, the supine position allows direct access to the airway, making it easier to control and evaluate. If needed, conversion from regional anesthesia to general in patients with the supine position is also less problematic. The supine position also promotes lesser changes in the heart and major blood vessels. The long duration of the PCNL procedure is more tolerable either for the patient, the operator, and anesthesia with the supine position.<sup>13,18</sup> The shortcoming of performing PCNL in supine position is a smaller area of puncture and dilation. Moreover, supine position means a greater distance between the skin and kidneys, hence maneuverability of the nephroscope becomes more limited. Also, renal pelvis relatively collapsed, causing puncture and dilation becomes more difficult in the supine position.<sup>13,18,21</sup>

## OBJECTIVE

This prospective study aims to compare the outcomes of PCNL with prone position compared to supine position.

## MATERIAL & METHODS

This is a prospective study, consists of 57 patients who were treated with PCNL from January 2017-December 2017 in Haji Adam Malik Hospital, Medan. The inclusion criteria in this study were those with kidney stones  $\geq 20$  mm in size, which were measured using photograph imaging of KUB

(Kidney-Ureter-Bladder) or abdominal NCCT (Non Contrast Computed Tomography) who are willing to be treated with PCNL surgery. The exclusion criteria of this study were patients who are younger than 17 years of age, patients who refused to PCNL surgery, patients who had a history of PCNL on the same side, patients with blood clotting disorders, pregnancy, and kidney stones in patients with congenital kidney disorders. The total sampling method was used in patient selection. Data consists of patient characteristics in terms of gender, age, body mass index, and comorbid diseases were included in the study.

A thorough anamnesis and physical examination were carried out, followed by ultrasound examination of the kidneys and bladder. If stones were present, the patient were examined further using an advanced imaging procedure, either KUB IVU (Intravenous Urography) or abdominal NCCT. Blood sample were also taken to check the patient's complete blood result, kidney function, blood clots, and electrolytes. Patients were also tested for blood glucose, ECG, blood gas analysis, and spirometry as part of surgery tolerance. Patients with creatinine  $\geq 2$  mg/dL were examined with KUB-IVU while patients with creatinine  $>2$  mg/dL were examined with NCCT abdominal examination.

From the results of KUB-IVU or abdominal NCCT, an analysis is conducted to find out the stone size, staghorn (print) or non-staghorn stones, and the presence or absence of hydronephrosis before PCNL surgery. Data regarding the size of the stone in the form of the largest stone size, smallest and stone burden recorded in units of millimeters. 'Stone burden' refers to the greatest diameter of each stone.<sup>22</sup> Whether a patient has staghorn or non-staghorn stones is also recorded. Hydronephrosis data taken is the presence or absence of hydronephrosis.

After complete examination and the patient is considered ready for surgery, they were recorded by urology residents, then randomly divided to be referred to urologists for PCNL treatment. PCNL is performed by 5 urologists who are already accustomed to doing PCNL with their chosen position. During the operation, data were recorded in the form of operating time, the number of punctures, single or multiple puncture, puncture site, and the use of nephrotomy or DJ stent after PCNL. The duration of surgery is calculated from the time the patient received anesthesia, drapping, positioning, placing a ureteral catheter, repositioning and

re-draping in prone position, renal function and dilation, stone fragmentation, to DJ stent placement or nephrostomy if necessary. The number of punctures is number of punctures performed until nephrostomy trocar is entered successfully. We also took note of whether PCNL puncture was performed with single or multiple puncture. Puncture location is the location of calyx where nephrostomy trocar is inserted. The use of nephrostomy after PCNL will be categorized as a PCNL tube, whereas if only used DJ stent or UC or not using nephrostomy, DJ stent, or UC, it will be classified as tubeless PCNL.<sup>23</sup> Indications to let nephrostomy remains post-PCNL is a long duration of PCNL, significant bleeding during PCNL, and presence of residual stones.<sup>24-25</sup>

Subsequently, a post-surgical examination with USG and KUB is performed to evaluate the presence or absence of residual stones. Patients were considered having residual stones if stones with a size of 5 mm is present on the side treated with PCNL using postoperative KUB imaging, or with ultrasound imaging that shows the presence of stones after 2 weeks since surgery was performed.<sup>20</sup> Complete blood tests were also taken after surgery. Hemoglobin before and after surgery is obtained to determine the difference as a delta value. Complications include the presence or absence of postoperative fever (body temperature with an axillary thermometer  $>38^{\circ}\text{C}$ ), bleeding, pleural effusion, intestinal injury, hematoma, urine leak and deaths that occur were also recorded in this study.

In PCNL with the prone position, the patient will be sedated, followed by lithotomy positioning, disinfection, and drapping. Ureter catheters (UC) are inserted into the ureter which PCNL will work on using a cystoscopy device. The UC serves to access injection contrast to visualize the pelvicalyceal system (PCS) of the kidney under fluoroscopy during puncture and dilation. The UC that we use is a 5 meter sized open ureter catheter. The UC will be positioned with a C-ARM guide until it is located on the ureteropelvic junction (UPJ) or under the stone causing obstruction. If the UC has difficulty getting into the kidneys, URS will be needed. URS rises to kidney PCS, then guidewire is abandoned and UC is installed through the guidewire and C-ARM guide. If installed properly, the UC will be fixed to the urethral catheter. Patients are then prone position, followed by re-disinfection and drapping.

With the guidance of C-ARM fluoroscopy, puncture to the intended target is accomplished using an 18 Gauge nephrostomy trocar. After trocar enters,

an insertion guide wire is carried out, followed by gradual dilation up to 28 or 30 Fr am Platz in, then insertion of the nephroscope. Nephroscope used in this study was 25 Fr. After the nephroscope enters and the stone is identified, a small stone can be taken directly with the forcep grasper, while the larger stone is treated by lithotripsy using a pneumatic descriptor. Stone fragments are removed using a forcep. At the end of the procedure, it is determined whether nephrostomy or DJ stent is necessary. If a fairly large perforation, considerably large amount of bleeding or a remarkably large residual stone is present, nephrostomy installment through PCNL will be necessary.

In supine position, PCNL patients were given anesthesia and then positioned semi-lithotomy. The patient's legs are positioned lithotomy with the ipsilateral foot slightly lower than the opposite foot. The patient in supine position is propped up using two bottles of 1 liter infusion, with one placed below the chest and the other placed below the pelvis. Disinfection and drapping is accomplished, followed by UC insertion using cystoscopy. If it is difficult for the UC to go upward to the kidney, the same procedure described in the prone position shall be taken, namely using URS. After UC is installed properly, puncture should be immediately executed to the kidneys with the guidance of the C-ARM guide, then the similar method as described in prone position is performed.

Statistical analysis was performed using SPSS version 21. Comparison of categorical data was analyzed with chi-square, while numerical data were analyzed using t-test. P-value  $<0.05$  is considered significant.

## RESULTS

The characteristics of the patients are shown in table 1. no significant differences were observed in terms of the number of patients, gender, age, body mass index, imaging used, kidney side performed, patients with printed stone, stone burden, hydronephrosis and comorbid diseases in patients treated with PCNL in both prone and supine position with a value of  $p > 0.05$ .

In all patients treated with PCNL, both prone and supine positions, punctures were successfully achieved with a maximum of 3 attempts. Inferior calyx puncture was performed in 23 prone patients and 22 supine patients, middle calyx puncture in 6 prone patients and 6 supine

patients, superior calyx puncture in 1 supine patient, and only 1 multiple puncture in supine PCNL patient. PCNL tube with leaving nephrostomy after PCNL was only performed in 1 supine patient and 1 PCNL prone patient. Both patients experienced

significant bleeding when PCNL was performed. Duration of operation on PCNL with prone position were 120-200 minutes with an average of 150 minutes while PCNL with supine position were 70-200 minutes with an average of 130 minutes (p=0.003)

**Table 1.** Patient Characteristics Data.

Number of Patients	Prone 29	Supine 28	p-value
Gender			0.903
Male	16	15	
Female	13	13	
Age	34-70 (54)	25-70 (55)	0.230
Body mass index	23.44 ± 2.42	22.84 ± 3.07	0.418
IVP imaging: NCCT	3:26	4: 24	0.650
Kidney Side (Right: Left)	17: 12	13:15	0.357
Staghorn Stone	19	11	0.047
Stone burden	37.1 ± 12.26	36.86 ± 11.05	0.937
Hydronephrosis	25	18	0.055
Comorbids	4	6	0.449
AKI / CKD	3	3	
CHF	1	2	
Asthma /COPD	0	1	

**Table 2.** Research Outcomes.

	Prone	Supine	P value
Puncture Location			0.6
Inferior Calyx	23	2 2	
Middle Calyx	6	6	
Kalik Superior	0	1	
Number of Puncture			0.305
Single	29	27	
Multiple	0	1	
Tube / Tubeless			0.980
PCNL Tube (Nephrostomy)	1	1	
Tubeless PCNL	28	27	
Duration of Surgery	120-200 (150)	70- 200 (130)	0.003
Residual Stone	5	2	0.246
Complications	6	11	0.125
Postoperative Fever	2	3	0.61
Sepsis	1	2	0.352
Bleeding Requires Transfusion	3	8	0.081
Retroperitoneal Hematoma	1	0	0.322
Pleural Effusion	0	0	
Colon Injury	0	0	
Hemoglobin Difference (ΔHb)	1.01 ± 1.90	1.13 ± 1.80	0.806

Residual stone with a size of 5 mm was found in 5 prone PCNL patients and 2 supine PCNL patients ( $p=0.246$ ). The stone-free rate in patients treated with prone-position and supine-position PCNL were 82.8% and 92.9%, respectively. Postoperative fever was experienced by 2 prone patients and 3 supine PCNL patients ( $p=0.61$ ). Sepsis occurs in 1 prone-PCNL patient and 2 supine-PCNL patients ( $p=0.352$ ). Bleeding requiring transfusion was experienced by 3 prone-PCNL patients and 8 supine-PCNL patients ( $p=0.081$ ). Retroperitoneal hematoma occurs in 1 prone-PCNL patient ( $p=0.322$ ). No patient has pleural effusion, intestinal injury, or death. The mean hemoglobin difference before and after surgery ( $\Delta Hb$ ) in prone and supine PCNL patients were  $1.01 \pm 1.90$  and  $1.13 \pm 1.80$  respectively ( $p=0.806$ ).

## DISCUSSION

PCNL has become the standard treatment for kidney stones greater than 20 mm in size.<sup>6</sup> PCNL is initially carried out in a prone position.<sup>9-10</sup> In 1987, Valdivia began to introduce PCNL in supine position.<sup>14-15</sup>

A successful puncture is obtained after a maximum of 3 trials on prone and supine PCNL. A study by Wang et al compared PCNL prone with supine obtaining puncture success  $\leq 3$  times in 50 out of 62 (81%) patients and at 45 out of 60 (75%) sequentially with  $p=0.45$ . Successful puncture in supine PCNL was not significantly different from prone position. The study from Wu et al. shows that the failure rate in prone positioned and supine positioned PCNL were 1.4% and 1.6% respectively.<sup>18</sup> Only 1 supine PCNL patient accomplished puncture from the superior calyx. Puncture in the superior calyx usually requires supracostal approach and it may increase the risk of pleural effusion or pneumothorax, hence puncture in this location is usually avoided. The number of successful punctures among supine and prone PCNL is not much of a difference, and access to each calyx is allowed in both positions as revealed by Mak and Rana et al.<sup>16,26</sup>

Significant differences in results were obtained at the length of operation. The average duration of PCNL surgery with the supine position was 130 minutes while the prone position was as long as 150 minutes ( $p=0.041$ ). PCNL with supine position can save up to 20 minutes. This result is similar to previous studies where PCNL with supine

position can spare between 20 to 30 minutes.<sup>13,22,25,27</sup>

In supine PCNL, there is no need to change the position of the patient, no patient disinfection and re-draping is needed. For doctors and surgical nurses, there is also no need for hand washing and the use of repeated surgery clothes. The supine PCNL allows for the installation of UC and kidney puncture to be performed by 2 operators. If URS is needed if there is a stone fragment that descends into the ureter when working on PCNL there is no need to reposition the patient if the patient is done in a supine position.<sup>28</sup> These factors cause differences in the long operating time of PCNL patients with prone and supine positions.

In this study, the stone-free rate in prone PCNL patients was as high as 82.8% compared to 92.9% in supine patients. The stone-free rate of supine patients in this study was also higher when compared with the results of previous studies ranged from 69 to 88%. Whereas in prone PCNL patients, the stone-free rate in this study is similar to the previous studies ranged from 77 to 91%.<sup>13,17,18,20,21,25,29</sup>

In PCNL with supine position, the nephroscope will be in a flat position or slightly sloop up in such a manner that the intra-PCS pressure is relatively lower and makes it easier for stone fragments to exit spontaneously through access to the nephroscope. In addition to stone fragments, blood can also be more easily evacuated, making the visualization easier when PCNL is performed.<sup>30</sup> These factors contribute to higher stone-free rates in PCNL patients treated in supine position compared to prone position.

The total complication in patients treated with PCNL in prone position was 6 out of 29 (20.7%) and 11 out of 28 in supine position (39.3%). This finding is not much of a difference compared to the previous studies with total complications of 13.9-32.3% PCNL complications in prone position and PCNL supine position 20.5-28.3%.<sup>20,22,25</sup>

Postoperative fever was found in 2 out of 29 (6.9%) prone-PCNL patients and in 3 out of 28 (10.7%) supine-PCNL patients. The results of this study are not much of a difference compared to previous studies that showed post-operative fever in prone-PCNL and supine-PCNL of 10.8% and 6.9% respectively. There was also no significant difference found in post-PCNL surgery either with prone or supine position. Sepsis occurred in 1 out of 29 (3.4%) prone-PCNL patients and in 2 out of 28 (7.1%) supine-PCNL patients. The previously reported sepsis incidence was 0.25-4.7%.<sup>31-32</sup> Intra

PCS pressure in PCNL performed with the supine position was lower than prone position, therefore it was expected that supine post PCNL fever rate was lower than prone position.<sup>17</sup>

Bansal et al. discovered that stones greater than 25 mm in size, length of operation longer than 120 minutes, and transfusion-required bleeding play a role in the onset of sepsis after PCNL. Moreover, staghorn stones and multiple access also affect the onset of post PCNL fever. Prophylaxis antibiotics given also influenced the incidence of post-operative fever.<sup>18,32</sup> The shortcoming of this study is the unavailability of routine urine culture procedure in patients who were planned to be treated by PCNL, hence, instead of according to culture, antibiotics given were only empirical antibiotics. The stone size in this study had a mean of  $37.1 \pm 12.26$  mm in patients who were treated with PCNL in prone position and  $36.86 \pm 11.05$  mm in patients who were treated in supine position, moreover the treatment procedure took a long time to execute (>120 minutes). This could be the cause of the fever rates obtained in this study are slightly higher compared to previous studies.

Transfusion-requiring hemorrhage was found in 3 out of 29 (10.3%) prone-PCNL patients and in 8 out of 28 (28.6%) supine-PCNL patients. The number of transfusion needs for PCNL varies from 3-8.8% in prone patients and 0-27.5% in supine patients.<sup>16-18,21</sup> Capsular and renal parenchymal bleeding can occur during initial puncture or dilation.<sup>33-34</sup> Bleeding may also be influenced by technical factors such as dilated instruments, the size of the sheath and nephroscope, and the type of lithotripter used in the procedure. Comorbid diseases such as CKD can also increase bleeding.<sup>17</sup> The difficulty of comparing bleeding requiring transfusion in PCNL is that bleeding in PCNL patients is difficult to assess, hence it highly depends on the experience of the operator and anesthesiologist. Differences in the patient's hemoglobin lower limit for postoperative transfusion may also be the cause of differences in the number of transfusion needs in each study.<sup>35</sup>

Retroperitoneal hematoma occurred in 1/29 (3.4%) of PCNL patients with prone positions. The patient experiences swelling in the waist, hematuria accompanied by complaints of fever 2 weeks after PCNL. After an abdominal CT scan, a retroperitoneal hematoma is found on the ipsilateral side. Then open surgery for evacuation of the hematoma and renorrhaphy is performed.

No patients experienced colon injury in this study. The incidence of colon injury in PCNL in the supine position is reported to be 0.5%.<sup>18</sup> Valdivia observes and compares CT scans in prone and supine positions. When the patient is in prone position, the colon is pushed anteriorly by the kidney, so that the colon and kidney attach to each other. However, in supine position, the colon is indeed located more anteriorly than the kidney.<sup>15</sup>

The disadvantage of this study was that it did not carry out preoperative culture as a routine, which might have a role in the incidence of postoperative fever. Furthermore, number of patients included is relatively small, and the PCNL procedure is carried out by 5 different operators, hence it may cause inter-operator differences in technique and experience.

## CONCLUSION

PCNL in supine position has the same effectiveness and safety as PCNL in prone position. The Stone free rate is higher in PCNL performed in supine position. The duration of PCNL surgery in supine position is significantly shorter than the PCNL prone position.

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